law is furnished by *Polygonum amphibium*. Kerner shows that the nectaries of this plant are entirely unprotected against the incursions of "unbidden guests." When growing in water this is no disadvantage, because none but flying insects can reach the flower. But when growing on land the nectar would be liable to be rifled by small creeping insects that would carry it away without performing any compensating service to the plant, and in such circumstances an innumerable quantity of glandular hairs make their appearance on the epidermis of the leaves and stem which effectually bar the way against the unwelcome visitors. "If the ground on which a *Polygonum* has grown for years in dryness, so as to have become covered with these trichomes, again be flooded, and the stems and peduncles again therefore be encircled with water, the trichomes with their viscidity disappear, and the epidermis again becomes smooth and even." I find this statement difficult to reconcile with a dictum laid down further on in the volume—and, as it appears to me, laid down hastily without sufficient warrant—that "the so-called process of 'adaptation' is never a direct one, never comes simply in response to a want. In other words, external conditions can never occasion an inheritable change of form, whether advantageous or the contrary, can neither determine the development of an organ nor its abortion."

Although glandular hairs or viscid secretions are the most common contrivances for preventing the access to the nectary of useless insects, they are by no means the only ones. The same object is attained by the prickles which cover the upper portion of the stem or the peduncles, and the spines into which the involucre of many Compositæ is converted. The waxy or even the glabrous epidermis in some plants prevents creeping insects from reaching the flowers. Even the latex or milky juice of such orders as Euphorbiaceæ, Convolvulaceæ, and Cichoriaceæ is pressed into the service. Kerner placed various kinds of ants on plants that were full of milky juice, such as the common lettuce. No sooner did they reach the uppermost leaves or peduncles than their feet cut through the tender epidermis of those parts, causing the latex to flow, which immediately glued the little animals to the stem so that they were totally unable to escape, and most of them miserably perished. The extra-floral nectaries, on the leaves or other parts of the plant, of *Viburnum tinus* and *opulus*, *Impatiens bicornis*, and many Leguminosæ, serve a similar purpose of diverting creeping, but not winged insects from the flower; since an insect crawling up the stem would always reach these secretions of nectar before the flower.

Some plants have to be protected from animals of a larger size, ruminants and other herbivorous quadrupeds. Some are altogether so protected by their prickly stem and leaves, or by the nauseous or unwholesome secretions of their tissues. But unpalatable secretions are much more common in the petals than the leaves; and with many plants the leaves are eagerly devoured by grazing animals or by caterpillars, while the flowers are left entirely untouched. While the comparatively large size of the flowers of alpine plants no doubt has for one object the attraction of hymenoptera and lepidoptera from a distance, the large area occupied by them in comparison to the leaves—the very character which renders many of them such favourite ornaments of our rockeries and flower-beds—doubtless also serves to protect them from destruction by goats and other mountain quadrupeds.

Space does not allow me even to refer to many other singular and interesting relationships pointed out by Prof. Kerner. It is of course quite possible that further examination may modify some of his conclusions in their detail. For example his belief that the main object of the viscid secretion on the leaves of *Pinguicula* is to prevent the access of creeping insects to the flower hardly appears consistent with the fact that most species of the genus flower early in the spring, while the secretion continues its activity through the summer and autumn. But the book is a perfect mine of original research, and is indispensable to all who are interested in the many problems connected with the fertilisation of flowers.

Dr. Ogle's translation is, with but little exception, easy and graceful. His editorial notes are useful, and he has adopted the praiseworthy practice—since the work is intended for non-scientific as well as for botanical readers—of explaining in foot-notes the meaning of technical terms used by the writer. In a future edition this practice might with advantage be extended. Such a term as "epiblasteme" does not carry its own meaning with it; and even botanists not well read up in recent literature would be puzzled by it. Or perhaps a glossary would be more useful. Three large-sized lithographic plates crowded with detail add greatly to the lucidity of the descriptions. ALFRED W. BENNETT

FLAMMARION ON DOUBLE STARS

Catalogue des Étoiles Doubles et Multiples en Mouvement relatif certain. Par Camille Flammarion. (Paris: G. Villars, 1878.)

IN this compact volume of less than two hundred octavo pages M. Flammarion has collected together the large number of measures of double and multiple stars, exhibiting change in the relative positions of the components, which have been made by various observers since the time of the father of double-star astronomy, Sir W. Herschel. Those who have been occupied in the study of this branch of the science will be well aware of the difficulty and trouble attending the preparation of a complete history of any of these objects from the measures being scattered through a great many astronomical works, some of them not always easily accessible, and M. Flammarion has not yet attached his name to any volume which is likely to compare with the present one in usefulness.

The author's authorities are about one hundred in number, and he refers to them by abbreviations, a list of which precedes his catalogue, but it is to be regretted that he has not also prefixed the titles of the volumes whence the various measures have been taken, and the more so as there are indications that the original authorities have not been invariably consulted. Thus a number of Capt. Jacob's measures made with the Lerebours equatorial at Madras and published in the first catalogue in the volume of Observations 1848-52, are omitted in M. Flammarion's lists, though he has others which appear in the second catalogue in the same volume, formed after the substitution of a new object-glass. In the case of π Lupi, where he regrets "que les étoiles australes soient

si négligées," he has omitted all Capt. Jacob's measures subsequent to 1848, and as instances where some measures are wanting, may be mentioned γ Argûs, ρ Herculis, δ Herculis, τ Ophiuchi, 70 Ophiuchi, ϵ Equulei 61 Cygni, θ Indi, &c., &c.

After exhibiting the measures of each object, M. Flammarion, in the great majority of cases, appends his own conclusions with respect to the cause of the relative changes of position, which have generally been carefully considered, though there are some few in which we should hardly be disposed to follow him. But the reader having nearly all that is known of the different objects before him, in M. Flammarion's summary, will be able to form his own inferences. If an observer he will be guided thereby to a selection of objects most worthy of his attention, or most requiring further measures for the elucidation of the cause of altered position.

In a provisional examination of the volume ample proof is afforded of the care taken by the author in his work, which has no doubt been as he describes it long and laborious. There are a few such oversights as H_3 3678 for H_2 4087; and under Procyon, misled by a measure of Secchi's in 1856 as printed, he refers to a companion at 83°·6 and 33″·16; this measure, however, really belonged to Powell's distant companion, and instead of 33″·16 the distance should be 331″·6, as it is given in another page of the same volume of Memoirs of the Roman Observatory. There is no reference to some of Argelander's determinations of proper motion, as in the case of a distant companion of γ Leonis, upon which M. Flammarion enters into some detail. Omissions like this, however, are perhaps unavoidable in the first preparation of such a work, but the author will doubtless have his attention called to them, and will be able to make his second edition a still more inclusive manual of double-star astronomy, than even this first impression.

Through the kindness of Leverrier, M. Flammarion was allowed the use of one of the equatorials at the Observatory of Paris during the year 1877 for the re-measurement of a number of the double stars; these measures applying to about 130 objects are given at the end of the preface to this volume: amongst them we note the close pair of 40 Eridani, a rapidly revolving star which has not received the attention it deserves from observers.

M. Flammarion's work will doubtless soon find its way into the hands of every one who is interested in the double and multiple stars, and he will certainly experience the satisfaction of receiving the well-earned thanks of many amateurs who have no convenient access to large astronomical libraries and to whom his volume will be a valuable *vade-mecum*.

OUR BOOK SHELF

The Mollusca of the Firth of Clyde; being a Catalogue of Recent Marine Species Found in that Estuary. By Alfred Brown. (Glasgow: Hugh Hopkins, 1878.)

ALTHOUGH the recent mollusca of this district have during the last few years received a good deal of attention, especially from the labours of M'Andrew, Barlee, and Merle Norman, still the various memoirs detailing the results of these labours were only to be found widely scattered through a number of scientific periodicals, and Mr. Brown has in this neatly printed work given us not only a *résumé* of the labours of the naturalists we have referred to, but also of all those who have collected on the Firth of Clyde, and joined these to the labours of Mr. David Robertson and his own. The result is, so far as the testaceous mollusca go, a large and apparently accurate catalogue, which will show not only what has been done but also among the nudibranchs and cuttle-fish what is yet to be done. The notes under the heading of Habitat in this catalogue are often most interesting, giving details not only of the exact localities for the species, but notes also of their local names.

Wanderings in Patagonia; or, Life among the Ostrich Hunters. By Julius Beerbohm. Map and Illustrations. (London: Chatto and Windus, 1879.)

THE title of this book is somewhat misleading, as the author's "Wanderings" were of a very limited extent, embracing only a small portion of the south-east coast region of Patagonia. Its most important feature is the account given of the life of the ostrich-hunters, and it adds little to our knowledge of Patagonia in addition to what has been told us by Musters and the one or two others who have really "explored" more or less of the wild region. The author's story is pleasant to read.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.*]

Tempel's Comet

THE well-known comet- and nebula-finder of the observatory of Arcetri, Tempel, has just made an observation of great interest in reference to his Comet No. II. of 1873, which, as astronomers know, has an orbit between Earth and Jupiter. It has no tail, but a nebular surrounding, which Tempel observed to be gradually diminishing in luminousness without losing bulk, and finally has entirely disappeared, leaving the comet perfectly distinct, but with a slight scintillation or rather an appearance of being composed of several masses having motion in the rest of the nucleus; probably an optical effect due to our own atmosphere, but which is at all events seen quite distinctly enough to make it certain that the disappearance of the nebulous surrounding is not due to failure of the telescope to show it.

The comet was last observed on December 18, at 6h. 53m. 12s. mean time of Arcetri in Right Ascension 23h. 3m. 14·15s., and in South Declination 19° 15′ 54″·8. It was seen on the 21st but briefly, and no observation could be made. Since then the continually cloudy sky has prevented it from being seen, but Tempel is confident of being able to see it through January. It is now amongst the asteroids. W. J. STILLMAN

Florence, January 1

The Cosine Galvanometer

IN NATURE, vol. xix. p. 98, my name appears in a way that might lead the reader to infer that I was the inventor of the "cosine galvanometer." My knowledge of this useful instrument was derived from Prof. Trowbridge, of Cambridge, U.S., who described it in 1871 in the *American Journal of Science*, vol. cii. p. 118. In my "Physical Manipulation" I omitted to mention Prof. Trowbridge's name, supposing that his connection with the instrument was too well known to render it necessary.

EDWARD C. PICKERING

Harvard College Observatory, Cambridge, U.S., December 20, 1878

Force and Energy [1]

II.

IN passing it may be noticed that the plus sign thus deduced for a tensive force is otherwise convenient because tension results in a positive increase of the dimensions in the direction of the tension of the body through which the tension is transmitted.

[1] Continued from p. 196.